

Requirements for this paper:Multi-choice cards: ☐

Non-programmable calculator:

☒

Open book examination?

☐ NO ☐

Graph paper:

Laptop:

☐**EXAMINATION/TEST:** TEST 1 (MEMO)**QUALIFICATION:** HonsBSc**MODULE CODE:** ITRI 613**DURATION:** 2 hours**MODULE DESCRIPTION:** Databases**MAX:** 60 Marks**EXAMINER(S):** Dr H. Mogale**DATE:** 14-04-21**TIME:** 16:00

TOTAL: 50**INSTRUCTIONS TO CANDIDATE**

Answer ALL questions

Make sure you have clear understanding of all the instructions and questions

Closed Book Examination

Non Programmable Calculator may be used

CANDIDATES ARE NOT ALLOWED TO READ QUESTIONS UNTIL THEY ARE TOLD TO DO SO BY THE CHIEF INVIGILATOR

Section A (Multiple Choice & Entity Relationship Modelling) - [20 Marks]

Question 1

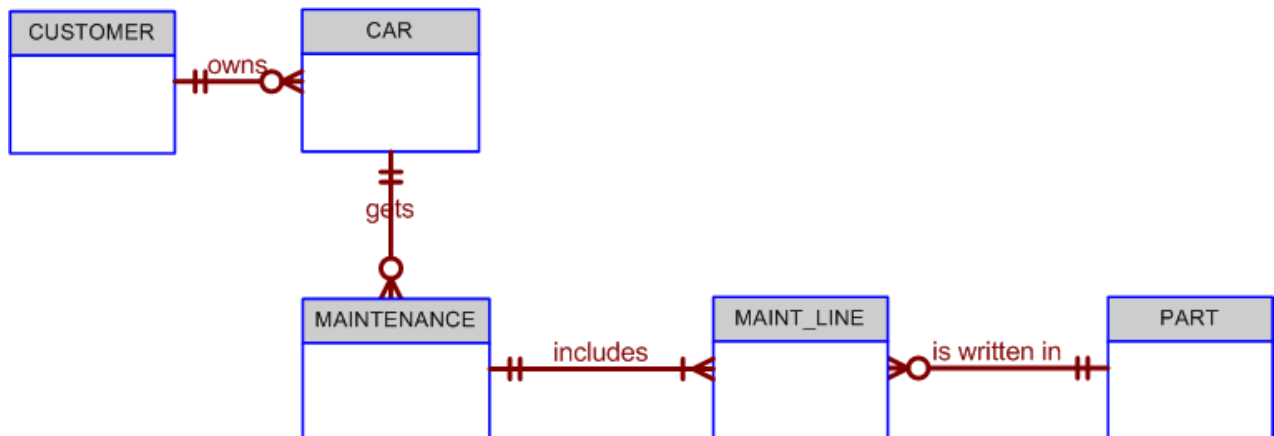
Answer the following **Multiple choice** questions by choosing the correct answer:

- ____ 1. ____ data can have only a true or false (yes or no) condition.
- | | |
|-------------------|------------|
| a. Logical | c. Date |
| b. Character | d. Numeric |
2. In the context of a database table, the statement “A ____ B” indicates that if you know the value of attribute A, you can look up the value of attribute B.
- | | |
|------------------|----------------------|
| a. contains | c. owns |
| b. is related to | d. determines |
3. In a database context, the word ____ indicates the use of the same attribute name to label different attributes.
- | | |
|-------------------|--------------|
| a. redundancy | c. duplicate |
| b. homonym | d. synonym |
4. A ____ is a super key with no repeated attributes.
- | | |
|-------------------------|-------------|
| a. Foreign key | c. Null key |
| b. Candidate key | d. Zero key |
5. A ____ attribute can be further subdivided to yield additional attributes.
- | | |
|---------------------|------------------|
| a. composite | c. single-valued |
| b. simple | d. multivalued |
6. In the ERD, cardinality is indicated using the ____ notation.
- | | |
|----------------------|------------------|
| a. (max, min) | c. [min ... max] |
| b. (min, max) | d. {min max} |
- ____ 7. Another word for existence-independent is ____.
- | | |
|----------|------------------|
| a. weak | c. unary |
| b. alone | d. strong |
8. A ____ is a relation, but we store a definition, rather than a set of tuples.
- | | |
|-------------------|-------------|
| a. Table | c. Database |
| b. Unary Relation | d. View |
- ____ 9. A condition that must be true for any instance of the database is also known as ____.
- | | |
|--------------------------------|---------------------------|
| a. Constraint | c. Overlapping Constraint |
| b. Integrity Constraint | d. None above |
10. Another name for a database administrator is known as ____.
- | | |
|---------------|---------------|
| a. DBA | c. DA |
| b. DB | d. None above |

[10 Marks]

Section B (Database Design) - [20 Marks]

Question 2



2.1 Given the above **ERD diagram** write the business rules that are reflected on it?

- **A customer can own many cars.**
- **Some customers do not own cars.**
- **A car is owned by one and only one customer.**
- **A car may generate one or more maintenance records.**
- **Each maintenance record is generated by one and only one car.**
- **Some cars have not (yet) generated a maintenance procedure.**
- **Each maintenance procedure can use many parts.**

(Comment: A maintenance procedure may include multiple maintenance actions, each one of which may or may not use parts. For example, 10,000-mile check may include the installation of a new oil filter and a new air filter. But tightening an alternator belt does not require a part.)

- **A part may be used in many maintenance records.**

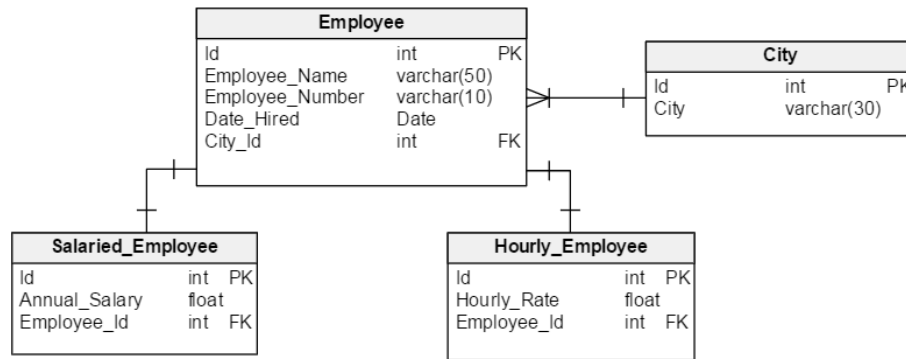
(Comment: Each time an oil change is made, an oil filter is used. Therefore, many oil filters may be used during some period of time. Naturally, you are not using the *same* oil filter each time – but the part classified as “oil filter” shows up in many maintenance records as time passes.)

[5Marks]

Section B (Database Design) - [20 Marks]

2.2 Giving an example is the difference between overlapping constraint and covering constraint?

[4Marks]



Overlapping Constraints: Can Alice be an Hourly employee as well as a Salaried Employee? If yes we must declare an *overlapping* constraint:

Hourly_emps OVERLAPS Salaried_emps

Covering constraints: Does every Employee entity **also have to be** an Hourly_Emps or a Salaried_Emps entity? If yes (and only if true) we can declare a *Covering* constraint:

Hourly_emps and Salaried_emps COVER Employees

2.3 What is the primary role of a system administrator?

System administrators are not necessarily confined with what they must do within their designated departments. They have a lot that they do. Some of the duties and responsibilities fulfilled by them include:

Installing and configuring software, hardware and networks. Monitoring system performance and troubleshooting issues. Ensuring security and efficiency of IT infrastructure

[1Marks]

Section B (Database Design) - [20 Marks]

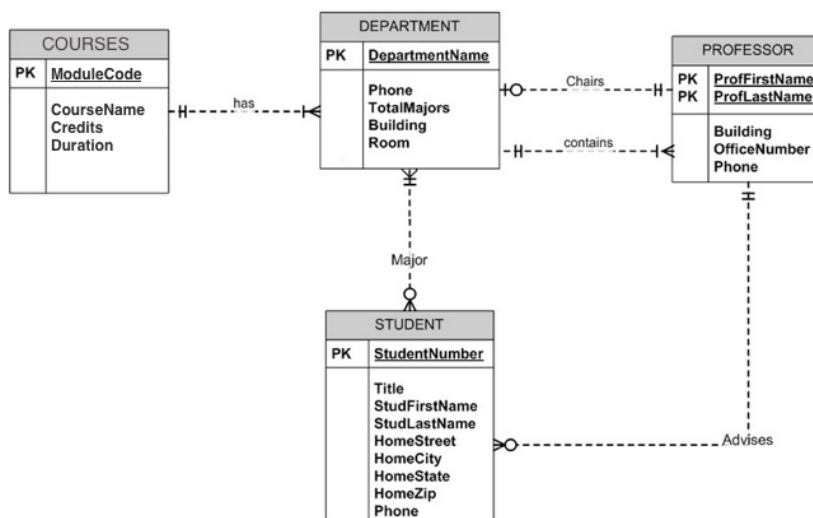
2.4 Name and define the five steps involved in **DB design model**?

- **Requirement's analysis** – Gathering and ensuring that DB meets all necessary user requirements. Requirements ensure that what operations are most frequent and subject to performance requirements.
- **Conceptual DB design** - using an ER model to develop a high-level description of the data to be stored in the database, along with the applicable constraints
- **Logical DB design** – At this stage of development we use ERM's to answer questions such as:
 - What are the *entities* and *relationships* in the enterprise?
 - What information about these entities and relationships should we store in the database?
- **Schema refinement (normalization)** - to analyse the collection of relations in our relational database schema to identify potential problems, and to refine it.
- **Physical design (indexes)** – Used to consider typical expected workloads that our database must support and further refine the database design

[5Marks]

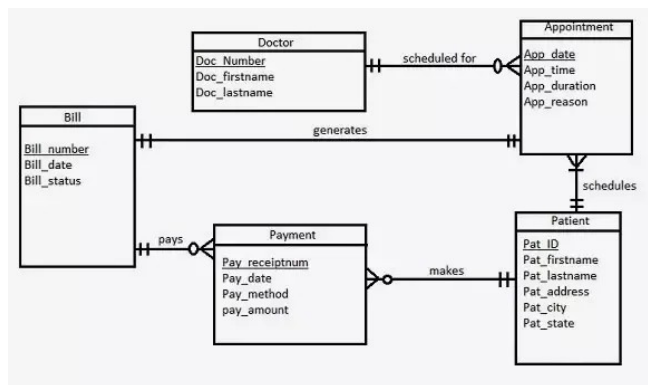
2.5 Design a simple database schema for **NWU Vaal Campus**, Include the following entities?

i) Student ii) Department iii) Professor iv) Courses



[5Marks]

Section C (Relational Model) - [20 Marks]



Question 3

1. What does it mean to say that a database displays both **entity integrity** and **referential integrity**?

Entity integrity describes a condition in which all tuples within a table are uniquely identified by their primary key. The unique value requirement prohibits a null primary key value, because nulls are not unique.

Referential integrity describes a condition in which requires that a foreign key must have a matching primary key or it must be null. referential integrity can be used to ensure foreign key values are valid.

When a database exhibits both Entity integrity and Referential integrity it means that it is a balanced state where all relationships have corresponding entities and all attributes and tuples follow all integrity rules.

[4 Marks]

2. Using examples describe what is the difference between **Secondary Key** and **Primary Key**?

Primary Key

- The attribute that uniquely identifies a row or record in a relation is known as primary key.
- An example would be a page number of a book

Secondary Key

- A field or combination of fields that is basis for retrieval is known as secondary key (mainly used for finding details from large data)
- An example would be an index page of a book

[4 Marks]

3. Referring to the above diagram provide an example of what can form an overlapping constraint?

In the above diagram an **overlapping constraint** will be witnessed when the entity **Doctor** can be allowed to be the entity **Patient** and vice versa. This is true in real life scenario because doctors may fall ill and become patients at a hospital.

[2 Marks]

Section C (Relational Model) - [20 Marks]

Question 4.

4. Referring to the diagram write SQL query to select all from the table **Doctor**?

SELECT * FROM DOCTOR;

5. Referring to the diagram write SQL query to drop the table **Bill**?

[2 Marks]

DROP TABLE Bill;

[2 Marks]

6. What happens to the DB when the table **Bill** is dropped and how is it affected?

Dropping a table removes the **table** definition from the data dictionary. All rows of the **table** are no longer accessible. All indexes and triggers associated with a **table** are **dropped**. When the table **Bill** gets dropped its associated relationships with the table **Payment** and **Appointment** will also be dropped.

It should also be noted that when you drop a table, normally the database does not immediately release the space associated with the table. Rather, the database renames the table and places it in a recycle bin, where it can later be recovered with the FLASHBACK TABLE statement if you find that you dropped the table in error. If you should want to immediately release the space associated with the table at the time you issue the DROP TABLE statement, include the PURGE clause as shown in the following statement:

DROP TABLE Bill PURGE;

[1 Marks]

Section C (Relational Model) - [20 Marks]

7. Write SQL code to create tables **Doctor**, **Appointment** and **Patient**?

```
CREATE TABLE DOCTOR (  
    Doc_Number INT NOT NULL,  
    Doc_firstName VARCHAR (20) NOT NULL,  
    Doc_lastName VARCHAR (20) NOT NULL,  
    PRIMARY KEY (Doc_Number)  
);
```

```
CREATE TABLE APPOINTMENT (  
    App_date DATE NOT NULL,  
    App_time TIME NOT NULL,  
    App_duration VARCHAR (20) NOT NULL,  
    PRIMARY KEY (App_date)  
);
```

```
CREATE TABLE PATIENT (  
    Pat_ID INT NOT NULL,  
    Pat_firstName VARCHAR (20) NOT NULL,  
    Pat_lastName VARCHAR (20) NOT NULL,  
    Pat_address VARCHAR (20) NOT NULL,  
    Pat_city VARCHAR (20) NOT NULL,  
    Pat_state VARCHAR (20) NOT NULL,  
    PRIMARY KEY (Pat_ID)  
);
```

// Zero foreign keys, Primary keys: **Pat_ID**, **App_date**, **Doc_Number**

[5 Marks]

TOTAL: 50 Marks